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High-Speed QRNG Based on Phase Noise of VCSEL and DFB Laser

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Abstract. Quantum random number generators (QRNGs) are crucial for cryptography and secure data transfer; however, existing implementations often compromise between speed, cost, and complexity. In this paper we present QRNG based on a phase noise of a vertical-cavity surface-emitting laser (VCSEL) heterodyned with distributed feedback (DFB) laser, that combines the ultra-narrow linewidth and stability of DFB lasers with the high entropy phase noise of VCSELs at 1550 nm. We characterize optical beats of the setup and implement the XOR post-processing algorithm to suppress correlations when the signal is digitized, achieving random bit generation at 12 Gbps. The generated sequences pass NIST SP 800-22 tests while operating at low bias currents and with high stability, therefore, it can be successfully implemented into quantum key distribution systems that demand both speed and reliability.

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